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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/589,962	NAGASAKA, HIROYUKI	
	Examiner	Art Unit	
	Christina Riddle	2882	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 03 November 2009.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1,3-12,14-31 and 33-39 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1, 3-12, 14-31, 33-39 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Status

1. Acknowledgment is made of the amendment filed on 11/03/2009 which amended claims 1, 3, 6, 12, 14, 19, 27, 31, 33, and 34, cancelled claims 2, 13, and 32, and added new claims 38 and 39. Claims 1, 3-12, 14-31, and 33-39 are currently pending.

Continued Examination Under 37 CFR 1.114

2. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 11/03/2009 has been entered.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 11 and 26 are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential steps, such omission amounting to a gap between the steps. See MPEP § 2172.01. The omitted steps are: development of the substrate,

and further processing of the substrate to produce the device as described with reference to Fig. 16.

Claim Rejections - 35 USC § 101 and 112

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claims 30 and 37 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

7. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

8. Claims 30 and 37 provides for the use of an exposure system according to claims 27 and 31, respectively, but, since the claim does not set forth any steps involved in the method/process, it is unclear what method/process applicant is intending to encompass. A claim is indefinite where it merely recites a use without any active, positive steps delimiting how this use is actually practiced.

Claims 30 and 37 are rejected under 35 U.S.C. 101 because the claimed recitation of a use, without setting forth any steps involved in the process, results in an improper definition of a process, i.e., results in a claim which is not a proper process claim under 35 U.S.C. 101. See for example *Ex parte Dunki*, 153 USPQ 678 (Bd.App.

1967) and *Clinical Products, Ltd.* v. *Brenner*, 255 F. Supp. 131, 149 USPQ 475 (D.D.C. 1966).

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. Claims 1, 3-12, 14-24, 26, 31, 33, 34, 36, and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sugita (JP 2000-021763) in view of Kudo (JP 10-340846, translation provided by applicant).

Regarding claim 1, Sugita teaches an exposure method in which a plurality of times of exposure is performed on a same photosensitive object (Abstract, solution, an exposure method to pattern a photoreceptive substrate where fine and rough exposure is performed at the same positions on the substrate) wherein

a substantial wavelength of an exposure light in a space between a projection optical system, which projects said exposure light on said photosensitive object, and said photosensitive object is different in at least one exposure in said plurality of times of exposure from another exposure (paragraph [0024], in multiple exposure steps, the substrate is exposed with light of different wavelengths. Paragraphs [0053] and [0063], an F2 laser (Fig. 11), with a wavelength of 157 nm, used in one apparatus was used for

a first exposure and an X-ray exposure apparatus (Fig. 13) was used for a second exposure. The F2 laser exposure wavelength is larger than that of the exposure apparatus using X-ray exposure), and

each of a plurality of areas on said photosensitive object is exposed by said plurality of times of exposure (Abstract, solution, positions of the substrate are exposed by both fine and rough exposure), and after said plurality of areas are exposed by one of said at least one exposure and said another exposure, said plurality of areas are exposed by the other of said at least one exposure and said another exposure (Abstract, solution, the rough and fine exposure steps are overlapped on the same positions of the substrate). However, Sugita does not appear to explicitly describe wherein in said at least one exposure, said space is in a state filled with a predetermined liquid.

However, Kudo teaches said space is in a state filled with a predetermined liquid in said at least one exposure (paragraph [0007], photosensitive object is exposed through a liquid with a controlled index of refraction).

It would have been obvious to one skilled in the art at the time of the invention to have included a liquid filling the space between the projection system and the photosensitive object as taught by Kudo in at least one exposure during the exposure method taught by Sugita since an immersion fluid is commonly used in the art to increase the numerical aperture of the projection exposure system to enable patterning of smaller feature sizes.

Regarding claim 3, Sugita as modified by Kudo further teaches wherein in said another exposure, said space is in a state filled with another liquid of a different type from said predetermined liquid (Kudo paragraph [0032], index of refraction of liquid is adjusted by adding ethyl alcohol to water, creating an immersion liquid of a different type).

It would have been obvious to one skilled in the art at the time of the invention to have included a different type of liquid filling the space between the projection system and the photosensitive object as taught by Kudo in the exposure method taught by Sugita since, as suggested by Kudo, an immersion fluid with a different type of liquid is commonly used to prevent dissolution of the photosensitive layer of resist on the surface of the photosensitive object (paragraph labeled [Second Embodiment]).

Regarding claim 4, Sugita as modified by Kudo further teaches said predetermined liquid has refractive index larger than the refractive index of said another liquid (Kudo [0033], the refractive index of the liquid is decreased by adding less ethyl alcohol).

It would have been obvious to one skilled in the art at the time of the invention to have included liquid with a lower index of refraction than another liquid as taught by Kudo in the exposure method taught by Sugita since an immersion fluid different refractivity is commonly used to allow improved control of numerical aperture for different process conditions, thereby allowing better control of imaging performance.

Regarding claim 5, Sugita as modified by Kudo further teaches said another liquid has solubility to a specific material contained within a photosensitive agent of said

photosensitive object lower than said predetermined liquid (Kudo paragraph labeled [A 2nd embodiment], between paragraphs [0029] and [0030], ethyl alcohol is used as an additive to water to avoid dissolving the photosensitive agent on the surface of the photosensitive object).

It would have been obvious to one skilled in the art at the time of the invention to have included a liquid with a lower solubility to material in photosensitive agent than another liquid as taught by Kudo, in the exposure method taught by Sugita since, as suggested by Kudo, an immersion fluid with a lower solubility to a photosensitive agent is commonly used to prevent dissolution of the photosensitive layer of resist on the surface of the photosensitive object (paragraph labeled [Second Embodiment]).

Regarding claim 6, Sugita teaches wherein in said another exposure, said space is in a state not filled with liquid (Figs. 11, 12, 13, 19, 20 and 24 are exposure apparatuses which have spaces between the projection lens and the photosensitive object not filled with liquid).

Regarding claim 7, Sugita also teaches that said at least one exposure is performed prior to said another exposure (Sugita, [0024], two exposure steps occur. Also, Paragraphs [0053] and [0063], an F2 laser (Fig. 11), with a wavelength of 157 nm, used in one apparatus was used for a first exposure and an X-ray exposure apparatus (Fig. 13) was used for a second exposure. The F2 laser exposure wavelength is larger than that of the exposure apparatus using X-ray exposure).

Regarding claim 8, Sugita further teaches wherein said at least one exposure is performed after said another exposure is performed (Sugita, paragraphs [0024], [0053],

and [0063], two exposure steps occur for a photosensitive object, one step in an exposure apparatus using a F2 laser light source and another step in an X-ray exposure apparatus).

Regarding claim 9, Sugita discloses wherein a wavelength of an exposure light made to enter said projection optical system in said at least one exposure is different from a wavelength of exposure light in said another exposure (paragraph [0024], in multiple exposure steps, the substrate is exposed with light of different wavelengths. Paragraphs [0053] and [0063], an F2 laser (Fig. 11), with a wavelength of 157 nm, used in one apparatus was used for a first exposure and an X-ray exposure apparatus (Fig. 13) was used for a second exposure.).

Regarding claim 10, the first embodiment of Sugita does not appear to explicitly describe wherein in said at least one exposure, a phase shift method is used.

However, the second embodiment of Sugita discloses wherein in said at least one exposure, a phase shift method is used (paragraph [0069], phase shift mask and ArF excimer laser can be used).

It would have been obvious to one skilled in the art at the time of the invention to use a phase shift mask as shown by the second embodiment taught by Sugita in the exposure apparatus taught by the first embodiment taught of Sugita since a phase shift mask in an exposure apparatus is commonly used in the art to improve pattern resolution.

Regarding claim 11, as best understood, Sugita discloses a device manufacturing method including a lithography process wherein the exposure method of

claim 1 is performed to expose a photosensitive object a plurality of times (Fig. 23 and para. [0117], a device manufacturing method is performed to manufacture semiconductor devices).

Regarding claim 12, Sugita teaches an exposure method in which a plurality of times of exposure is performed on a same photosensitive object (Abstract, solution, an exposure method to pattern a photoreceptive substrate where fine and rough exposure is performed at the same positions on the substrate), said method comprising:

exposing, under a first exposure condition where a substantial wavelength of said exposure light in a space between an optical member and said photosensitive object is a first wavelength, said photosensitive object is exposed by said exposure light of said first wavelength (paragraph [0024], in multiple exposure steps, the substrate is exposed with light of different wavelengths. Paragraphs [0053] and [0063], an F2 laser (Fig. 11), with a wavelength of 157 nm, used in one apparatus was used for a first exposure.); and

exposing, under a second exposure condition where a substantial wavelength of said exposure light in a space between said optical member and said photosensitive object is a second wavelength different from said first wavelength, said photosensitive object is exposed by said exposure light of said second wavelength (paragraph [0024], in multiple exposure steps, the substrate is exposed with light of different wavelengths. Paragraphs [0053] and [0063], an F2 laser (Fig. 11), with a wavelength of 157 nm, used in one apparatus was used for a first exposure and an X-ray exposure apparatus (Fig.

13) was used for a second exposure. The F2 laser exposure wavelength is larger than that of the exposure apparatus using X-ray exposure), wherein

each of a plurality of areas on said photosensitive object is exposed by said plurality of times of exposure (Abstract, solution, positions of the substrate are exposed by both fine and rough exposure), and after said plurality of areas are exposed by one of the exposure under said first exposure condition and the exposure under said second exposure condition, said plurality of areas are exposed by the other of the exposure under said first exposure condition and the exposure under said second exposure condition (Abstract, solution, the rough and fine exposure steps are overlapped on the same positions of the substrate). However, Sugita does not appear to explicitly describe wherein exposure under said first exposure condition is an immersion exposure performed in a state where said space is filled with a predetermined liquid.

However, Kudo discloses exposure under said first exposure condition is an immersion exposure performed in a state where said space is filled with a predetermined liquid (paragraph [0007], photosensitive object is exposed through a liquid, with a refractive index adjustment device (and thus, controlling the liquid to a predetermined index of refraction)).

It would have been obvious to one skilled in the art at the time of the invention to have included a liquid filling the space between the projection system and the photosensitive object as taught by Kudo as exposure under the first exposure condition in the exposure method taught by Sugita since an immersion fluid is commonly used in

the art to increase the numerical aperture of the projection exposure system to enable patterning of smaller feature sizes.

Regarding claim 14, Sugita as modified by Kudo further teaches wherein exposure under said second exposure condition is an immersion exposure performed in a state where said space is filled with another liquid different from said predetermined liquid (Kudo, paragraph [0030], a liquid additive of a different type fills the space).

It would have been obvious to one skilled in the art at the time of the invention to have included a liquid filling the space between the projection system and the photosensitive object with a second liquid different from the first as taught by Kudo, in the exposure method taught by Sugita in view of Kudo since an immersion fluid with a different index of refraction is commonly used in the art to increase the numerical aperture of the projection exposure system to enable patterning of smaller feature size.

Regarding claims 15 and 16, Sugita as modified by Kudo further teaches wherein said predetermined liquid has a refractive index different from and larger than said another liquid (paragraph [0030], a liquid additive of a different type, and thus a different refractive index, fills the space, and Kudo [0033], the refractive index of the liquid is decreased by adding less ethyl alcohol).

It would have been obvious to one skilled in the art at the time of the invention to have included liquid with a lower index of refraction than another liquid as taught by Kudo in the exposure method taught by Sugita since an immersion fluid different refractivity is commonly used to allow improved control of numerical aperture for different process conditions.

Regarding claims 17 and 18, Sugita as modified by Kudo further teaches said another liquid has solubility to a specific material contained within a photosensitive agent of said photosensitive object different and smaller than said predetermined liquid (Kudo paragraph labeled [A 2nd embodiment], between paragraphs [0029] and [0030], ethyl alcohol is used as an additive to water to avoid dissolving the photosensitive agent on the surface of the photosensitive object).

It would have been obvious to one skilled in the art at the time of the invention to have included a liquid with a lower solubility to material in photosensitive agent than another liquid as taught by Kudo, in the exposure method taught by Sugita since, as suggested by Kudo, an immersion fluid with a lower solubility to a photosensitive agent is commonly used to prevent dissolution of the photosensitive layer of resist on the surface of the photosensitive object (paragraph labeled [Second Embodiment]).

Regarding claim 19, Sugita teaches wherein exposure under said second exposure condition is a dry exposure performed in a state where said space is not filled with liquid (Sugita paragraphs [0053] and [0063], an F2 laser exposure apparatus and an X-ray exposure apparatus (Fig. 13) were used for a second exposure, which are both dry exposure methods).

Regarding claims 20-21, Sugita further teaches said exposure under said first exposure condition is performed prior to said exposure under said second condition (Sugita, [0024], two exposure steps, one must occur before the other and both the F2 laser and X-ray exposure apparatuses are performed without liquid), and that said exposure under said first exposure is performed after said exposure under said second

exposure has been performed (Sugita, [0024], two exposure steps, one must occur before the other and both the F2 laser and X-ray exposure apparatuses are performed without liquid).

Regarding claim 22, Sugita discloses wherein a wavelength of an exposure light made to enter said projection optical system under said first exposure condition is different from the wavelength of exposure light in exposure under said second exposure condition (paragraph [0024], in multiple exposure steps, the substrate is exposed with light of different wavelengths. Paragraphs [0053] and [0063], an F2 laser (Fig. 11), with a wavelength of 157 nm, used in one apparatus was used for a first exposure and an X-ray exposure apparatus (Fig. 13) was used for a second exposure.).

Regarding claim 23, the first embodiment of Sugita does not appear to explicitly describe wherein in said exposure under said first exposure condition, a phase shift method is used.

However, the second embodiment of Sugita discloses wherein in said exposure under said first exposure condition, a phase shift method is used (paragraph [0069], phase shift mask and ArF excimer laser can be used).

It would have been obvious to one skilled in the art at the time of the invention to use a phase shift mask as taught by the second embodiment of Sugita in the exposure method taught by the first embodiment of Sugita since a phase shift mask in an exposure apparatus is commonly used in the art to improve pattern resolution.

Regarding claim 24, Sugita discloses said exposure under said first exposure condition and said exposure under said second exposure condition are severally

executed in a different exposure apparatus (paragraphs [0053] and [0063], an F2 laser (Fig. 11) used in one apparatus was used for a first exposure and an X-ray exposure apparatus (Fig. 13) was used for a second exposure).

Regarding claim 26, as best understood, Sugita discloses a device manufacturing method including a lithography process wherein the exposure method of claim 1 is performed to expose a photosensitive object a plurality of times (Fig. 23 and para. [0117], a device manufacturing method is performed to manufacture semiconductor devices).

Regarding claim 31, Sugita discloses an exposure system that performs exposure on a same photosensitive object a plurality of times (Abstract, solution, an system to pattern a photoreceptive substrate where fine and rough exposure is performed at the same positions on the substrate), said system comprising:

a first exposure apparatus whose substantial wavelength of an exposure light in a space between said photosensitive object and a projection optical system, which projects said exposure light on said photosensitive object, is a first wavelength (paragraph [0024], in multiple exposure steps, the substrate is exposed with light of different wavelengths. Paragraphs [0053] and [0063], an F2 laser (Fig. 11), with a wavelength of 157 nm, used in one apparatus was used for a first exposure.); and

a second exposure apparatus whose substantial wavelength of an exposure light in a space between said photosensitive object and a projection optical system, which projects said exposure light on said photosensitive object, is a second wavelength different from said first wavelength (paragraph [0024], in multiple exposure steps, the

substrate is exposed with light of different wavelengths. Paragraphs [0053] and [0063], an F2 laser (Fig. 11), with a wavelength of 157 nm, used in one apparatus was used for a first exposure and an X-ray exposure apparatus (Fig. 13) was used for a second exposure. The F2 laser exposure wavelength is larger than that of the exposure apparatus using X-ray exposure), wherein

each of a plurality of areas on said photosensitive object is exposed in said first exposure apparatus and said second exposure apparatus (Abstract, solution, positions of the substrate are exposed by both fine and rough exposure), and after said plurality of areas are exposed by one of the exposure with said exposure light of a said first wavelength and the exposure light of said second wavelength, said plurality of areas are exposed by the other of the exposure with said exposure light of said first wavelength and the exposure with said exposure light of said second wavelength (Abstract, solution, the rough and fine exposure steps are overlapped on the same positions of the substrate). However, Sugita does not appear to explicitly describe wherein in said first exposure apparatus, a predetermined liquid is filled between said projection optical system and said photosensitive object when said exposure light is projected on said photosensitive object.

However, Kudo discloses wherein in said first exposure apparatus, a predetermined liquid is filled between said projection optical system and said photosensitive object when said exposure light is projected on said photosensitive object (paragraph [0007], photosensitive object is exposed through a liquid with a refractive index control and adjustment device).

It would have been obvious to one skilled in the art at the time of the invention to have included a liquid filling the space between the projection system and the photosensitive object as taught by Kudo in the exposure system taught by Sugita since an immersion fluid is commonly used in the art to increase the numerical aperture of the projection exposure system to enable patterning of smaller feature sizes.

Regarding claim 33, Sugita in view of Kudo further teaches wherein in said second exposure apparatus, another liquid having a refractive index smaller than said predetermined liquid is filled between said projection optical system and said photosensitive object when said exposure light is projected on said photosensitive object (Kudo paragraph [0007], index of refraction of liquid is adjusted, creating an immersion liquid of a different type, and [0033], the refractive index of the liquid is decreased by adding less ethyl alcohol).

It would have been obvious to one skilled in the art at the time of the invention to have included liquid with a lower index of refraction than another liquid as taught by Kudo in the exposure system as taught by Sugita since an immersion fluid different refractivity is commonly used to allow improved control of numerical aperture for different process conditions.

Regarding claim 34, Sugita discloses wherein in said second exposure apparatus, liquid does not exist between said projection optical system and said photosensitive object when said exposure light is projected on said photosensitive object (Sugita paragraphs [0053] and [0063], an F2 laser exposure apparatus and an X-

ray exposure apparatus (Fig. 13) are used for a second exposure, which are both dry exposure tools).

Regarding claim 36, Sugita discloses wherein oscillation wavelength of a light source emitting said exposure light of said first exposure apparatus is different from oscillation wavelength of a light source emitting said exposure light of said second exposure apparatus (paragraph [0024], in multiple exposure steps, the substrate is exposed with light of different wavelengths. Paragraphs [0053] and [0063], an F2 laser (Fig. 11), with a wavelength of 157 nm, used in one apparatus was used for a first exposure and an X-ray exposure apparatus (Fig. 13) was used for a second exposure).

Regarding claim 37, as best understood, Sugita discloses a device manufacturing method including a lithography process wherein the exposure method of claim 1 is performed to expose a photosensitive object a plurality of times (Fig. 23 and para. [0117], a device manufacturing method is performed to manufacture semiconductor devices).

11. Claims 25, 38 and 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sugita as modified by Kudo as applied to claims 1 and 12 above, and further in view of Berman et al. (US Patent No. 6,894,762, Berman hereinafter).

Regarding claim 25, Sugita as modified by Kudo does not appear to explicitly describe wherein said exposure under said first exposure condition and said exposure under said second exposure condition are severally executed in a same exposure apparatus.

However, Berman discloses wherein the exposure apparatus is a single exposure apparatus (Fig. 3 and col. 8, lines 36-55, dual source lithography system 300 includes two stages 306, 308 for transferring the wafer from one module to the other module for sequential pattern formation on the same resist layer on the wafer).

It would have been obvious to one of ordinary skill in the art at the time of the invention to have included using a single exposure apparatus as taught by Berman with the exposure method taught by Sugita as modified by Kudo since, as shown by Berman, using a single exposure apparatus is commonly used to perform high-resolution lithography that also improves throughput and lowers the cost of ownership (col. 1, lines 60-63) since the wafers need only go through one loadlock to be patterned twice (as shown in Fig. 3, wafers enter system 300 through input port 327).

12.

Regarding claims 38 and 39, Sugita as modified by Kudo does not appear to explicitly describe wherein said exposure method is performed using a single exposure apparatus.

However, Berman discloses using a single exposure apparatus (dual source lithography system 300, Fig. 1) for an exposure method in which a plurality of times of exposure is performed on a same photosensitive object (Fig. 3 and col. 8, lines 36-55, dual source lithography system 300 includes two stages 306, 308 for transferring the wafer from one module to the other module for sequential pattern formation on the same resist layer on the wafer).

It would have been obvious to one of ordinary skill in the art at the time of the invention to have included using a single exposure apparatus as taught by Berman with the exposure method taught by Sugita as modified by Kudo since, as shown by Berman, using a single exposure apparatus is commonly used to perform high-resolution lithography that also improves throughput and lowers the cost of ownership (col. 1, lines 60-63) since the wafers need only go through one loadlock to be patterned twice (as shown in Fig. 3, wafers enter system 300 through input port 327).

13. Claims 27, 29, and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sugita in view of Kudo and further in view of Berman et al. (US Patent No. 6,894,762, Berman hereinafter).

Regarding claim 27, Berman discloses an exposure apparatus (lithography system 300, Fig. 3) that performs a plurality of times of exposure on a same photosensitive object (col. 2, lines 1-14 and col. 8, lines 36-55, a first exposure is performed on a wafer and a second exposure is performed on the same wafer to expose both critical and non-critical regions), said apparatus comprising: a stage (stages 306 and 308, Fig. 3) that holds said photosensitive object (Fig. 3, stages 306 and 308 hold wafers); a projection optical system (projection lens 314 and electo-optical column 322, Fig. 3) that projects an exposure light on said photosensitive object (Fig. 3, light is projected through projection lens 314 to the wafer as electro-optical column 322 is used to control the electron beam for patterning the wafer), and in at least one exposure of said plurality of times, said substantial wavelength of said exposure light in

said space is different from the wavelength in another exposure (Fig. 3 and col. 8, lines 36-55, the wafer is exposed with illumination light from light source 310 through projection lens 314 with a wavelength different from the exposure wavelength of the electron beam of the e-beam lithography module 304 also used to pattern the wafer), wherein the exposure apparatus is a single exposure apparatus (Fig. 3 and col. 8, lines 36-55, dual source lithography system 300 includes two stages 306, 308 for transferring the wafer from one module to the other module for sequential pattern formation on the same resist layer on the wafer). However, Berman does not appear to explicitly disclose an adjustment unit that adjusts a substantial wavelength of said exposure light in a space between said projection optical system and said photosensitive object, adjustment unit; and a control unit that controls said adjustment unit when exposing said photosensitive object a plurality of times.

However, Kudo teaches an adjustment unit that adjusts a substantial wavelength of said exposure light in a space between said projection optical system and said photosensitive object (paragraph [0030]-[0031] and Fig. 3, adjustment unit, supply pipe LS and LQ and valves DVLS, DVLWS, and DVL, controls the index of refraction by supplying the additive liquid to the space between the projection system and the photosensitive object. Adjusting the index of refraction, in turn adjusts the wavelength of exposure light in the space.); and a control unit that controls said adjustment unit when exposing said photosensitive object a plurality of times (Fig. 3 and paragraph [0031], control unit, CPU 2, controls the operation of the adjustment unit (valves) to adjust the index of refraction and thereby, the wavelength).

It would have been obvious to one skilled in the art at the time of the invention to include an adjustment unit to adjust wavelength and a control unit that controls the adjustment unit as taught by Kudo in the exposure apparatus taught by Sugita since a wavelength adjustment and control unit is commonly used in the art to correct shifts in wavelength emitted by the laser that occur over time in order to maintain correct equipment operation.

Regarding claim 29, Berman as modified by Kudo further teaches said adjustment unit comprises a liquid supply mechanism that supplies any one liquid of a plurality of types of liquid so that in a space between said projection optical system and said stage, at least a space between said projection optical system and said photosensitive object on said stage is filled with said liquid (Kudo Fig. 3 and paragraphs [0030]-[0031], liquid supply mechanism, supply pipes LS, LQ, and exhaust pipe L in addition to valves DVLS, DVLWS, and DVL can supply and control the flow of ethyl alcohol, water, and a mixture of ethyl alcohol and water, supply a predetermined liquid to the space), whereby said control unit controls said adjustment unit so that said liquid supply mechanism supplies a predetermined liquid of said plurality of types of liquid to said space between said projection optical system and said photosensitive object on said stage in said at least one exposure, whereas in said another exposure said liquid supply mechanism supplies a liquid different from said predetermined liquid to said space (Kudo Fig. 3 and paragraph [0031], control unit, CPU 2, controls the operation of the adjustment unit (pipes and valves) to adjust the index of refraction and thereby, the wavelength).

It would have been obvious to one skilled in the art at the time of the invention to include a liquid supply mechanism that supplies a plurality of types of liquid to the space as taught by Kudo in the exposure apparatus taught by Berman since supplying a variety of liquids in a wavelength adjustment and control unit is commonly used in the art to correct shifts in wavelength emitted by the laser that occur over time in order to maintain correct equipment operation, while ensuring that the liquids used in the immersion space do not adversely effect imaging due to interaction with the surface of the photosensitive film on the object to be exposed.

Regarding claim 30, as best understood, Berman discloses a device manufacturing method including a lithography process wherein a device pattern is transferred onto a photosensitive object by using the exposure apparatus according to claim 27 (Fig. 3 and para. col. 1, lines 12-24, a device manufacturing method is performed to manufacture semiconductor devices using photolithography).

14. Claim 28 is rejected under 35 U.S.C. 103(a) as being unpatentable over Berman as modified by Kudo as applied to claim 27 above, and further in view of Fujishima et al. (JP2000-058436, Fujishima hereinafter).

Regarding claim 28, Berman as modified by Kudo further teaches said adjustment unit comprises a liquid supply mechanism that supplies a predetermined liquid so that in a space between said projection optical system and said stage, at least a space between said projection optical system and said photosensitive object on said stage is filled with said liquid (Kudo Fig. 3 and paragraphs [0030]-[0031], liquid supply

mechanism, supply pipes LS and LQ and valves DVLS, DVLWS, and DVL, supply a predetermined liquid to the space), whereby said control unit controls said adjustment unit so that said liquid supply mechanism supplies said liquid to said space between said projection optical system and said photosensitive object on said stage in said at least one exposure (Kudo Fig. 3 and paragraph [0031], control unit, CPU 2, controls the operation of the adjustment unit (pipes and valves) to adjust the index of refraction and thereby, the wavelength). However, Sugita as modified by Kudo in view of Berman does not appear to explicitly describe wherein in said another exposure said liquid supply mechanism does not supply said liquid to said space.

However, Fujishima teaches in said another exposure said liquid supply mechanism does not supply said liquid to said space (paragraph [0007]-[0009] and Fig. 1, an exposure apparatus is capable of imaging a photosensitive object via a space not filled with liquid, though it is also capable of imaging the object through liquid contained in container 3 that can be placed in the imaging beam path between the projection system 2 and the photosensitive object 5a).

It would have been obvious to one skilled in the art at the time of the invention to have a space between the projection system and the photosensitive object not filled with liquid during an exposure as taught by Fujishima in the exposure apparatus taught by Berman as modified by Kudo since performing one exposure in a state in which the space between the projection system and the object to be exposed is not filled with liquid is commonly known in the art to be a faster method of exposure than immersion exposure, thereby improving throughput in multiple exposure techniques.

15. Claim 35 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sugita as modified by Kudo as applied to claim 31 above and further in view of Ando et al. (US Patent No. 5,989,759, referred to as Ando hereinafter).

Regarding claim 35, Sugita as modified by Kudo does not appear to explicitly describe wherein a number of said first exposure apparatus is larger than a number of said second exposure apparatus.

However, Ando discloses wherein a number of said first exposure apparatus is larger than a number of said second exposure apparatus (Fig. 1, there are more electron beam exposure devices 2 than deep-UV stepper 1).

It would have been obvious to one of ordinary skill in the art at the time of the invention to have a larger number of one type of exposure apparatus than another type of exposure apparatus taught by Ando in the exposure system taught by Sugita as modified by Kudo since, as shown by Ando, including more of one type of exposure apparatus than another type of exposure apparatus can improve throughput by increasing the number of the throughput-limiting exposure apparatus while ensuring a high resolution (col. 2, lines 31-36 and 39-41).

Response to Arguments

16. Applicant's arguments with respect to claim 27 have been considered but are moot in view of the new ground(s) of rejection.

17. Applicant's arguments filed 11/03/2009 have been fully considered but they are not persuasive.

Applicant argues, on pages 10-12 regarding claims 1, 12, and 31, that the combination of Sugita in view of Kudo would not have been obvious since "features that are known in one reference to produce a certain result does not mean it would have been obvious to combine those features with another reference." Applicant also argues that “the claims recite a combination of elements that together perform a new or different function as compared to the individual elements found in the prior art. That is, the claimed invention provides a faster method with a maintained high accuracy.” However, the examiner respectfully disagrees since it is well known in the art to include mixing different exposure tools and methods of exposure with different imaging capabilities to improve throughput while maintaining high accuracy. For instance, Berman et al. (US Patent No. 6,894,762) discloses Fig. 3 as an exposure system with two exposure modules, one capable of finer patterning but slower, than the other, is used to obtain higher throughput while performing high resolution lithography (see col. 1, lines 60-63). Thus, since Sugita discloses using one exposure tool with high speed but comparatively lower imaging capability and an exposure tool with lower speed but comparatively higher imaging capability, and Kudo teaches that an immersion apparatus is used to improve imaging capability, it would have been obvious to a person having ordinary skill in the art at the time of the invention to have included an immersion tool as the tool with higher imaging capability in order to improve the overall throughput while maintaining imaging quality. The improvement in throughput and image quality

would have been predictable improvements as evidenced by the improvement in throughput and image quality in the lithography system taught by Berman. Thus, Applicant's argument on this point has not been found to be persuasive.

Furthermore, the examiner would like to point out that claims 1 and 12, as currently recited, place no requirement on when each exposure condition is carried out. That is, the exposure method may include exposing the wafer under the first exposure condition, developing the wafer, then performing exposure under the second exposure condition. Thus, many other semiconductor processes could intervene between the first and second exposures as the claims currently stand.

Conclusion

18. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Sugihara et al. (US Patent No. 6,093,931) discloses multiple exposure using different tools with different wavelengths.

Hirukawa (US PGPub 2006/0068301) discloses multiple exposure apparatuses with different wavelengths of illumination light.

Sugita et al. (US PGPub 2005/0099614) discloses exposing a wafer twice before development.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christina Riddle whose telephone number is (571)270-7538. The examiner can normally be reached on Monday- Thursday 7:00-17:30 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Edward Glick can be reached on (571)272-2490. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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/Peter B. Kim/
Primary Examiner, Art Unit 2882

/C. R./
Examiner, Art Unit 2882